(No Model.)

A. CHAPMAN.

EVAPORATING APPARATUS.

No. 411,011. Patented Sept. 17, 1889.

Fig. 3.

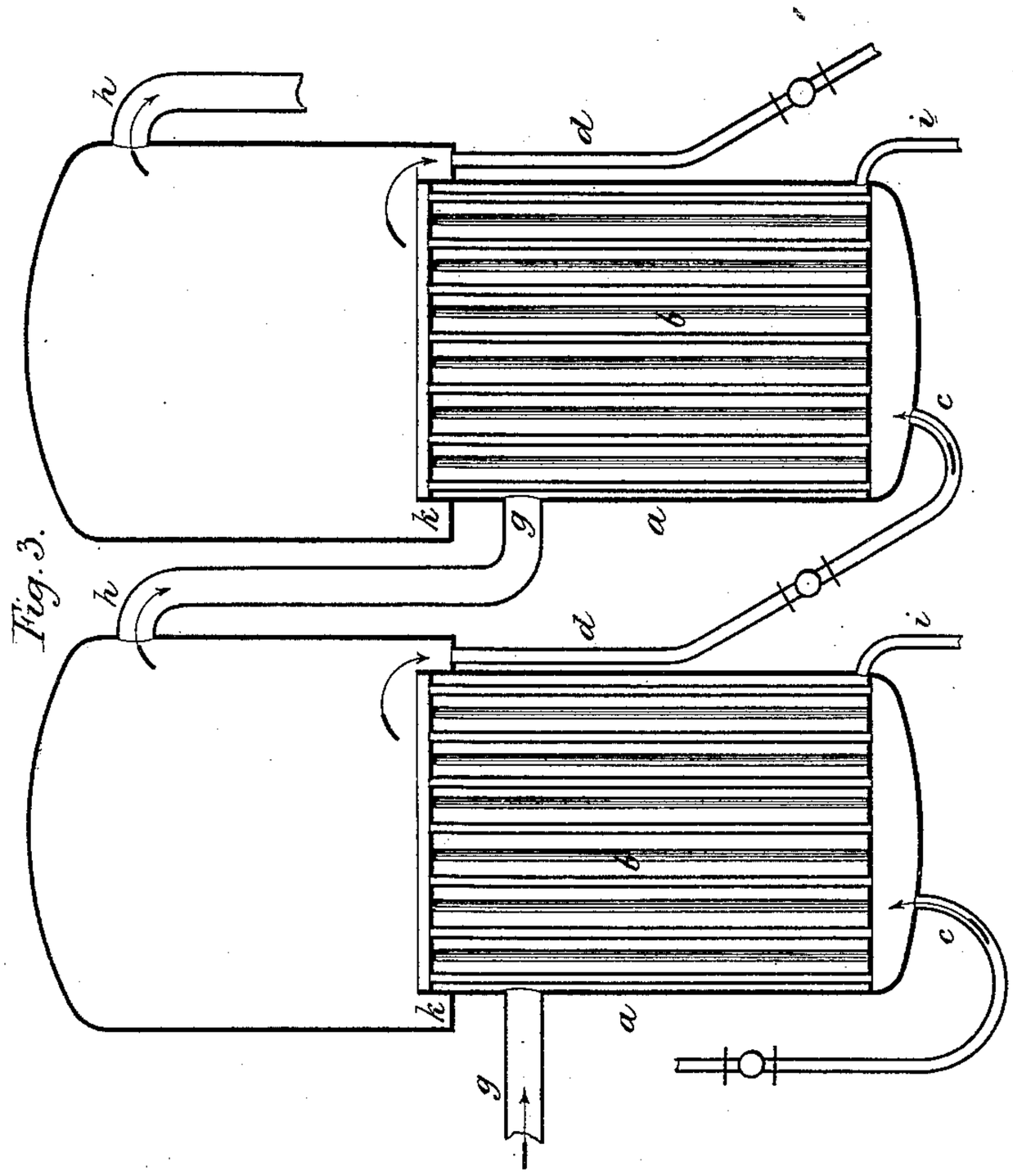


Fig. 4.

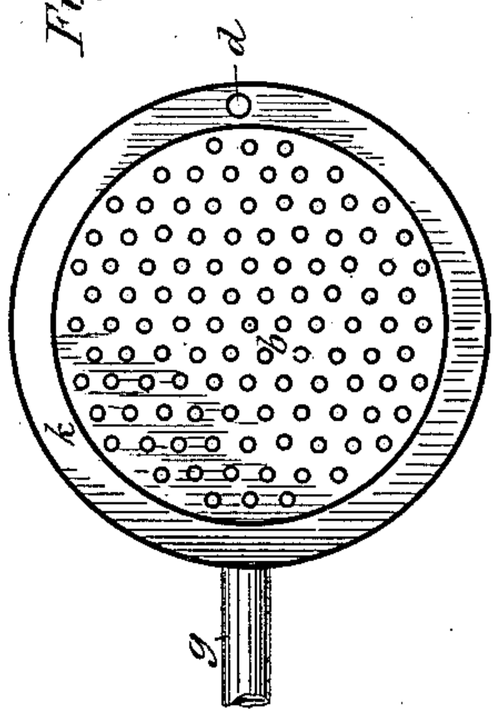


Fig. 1.

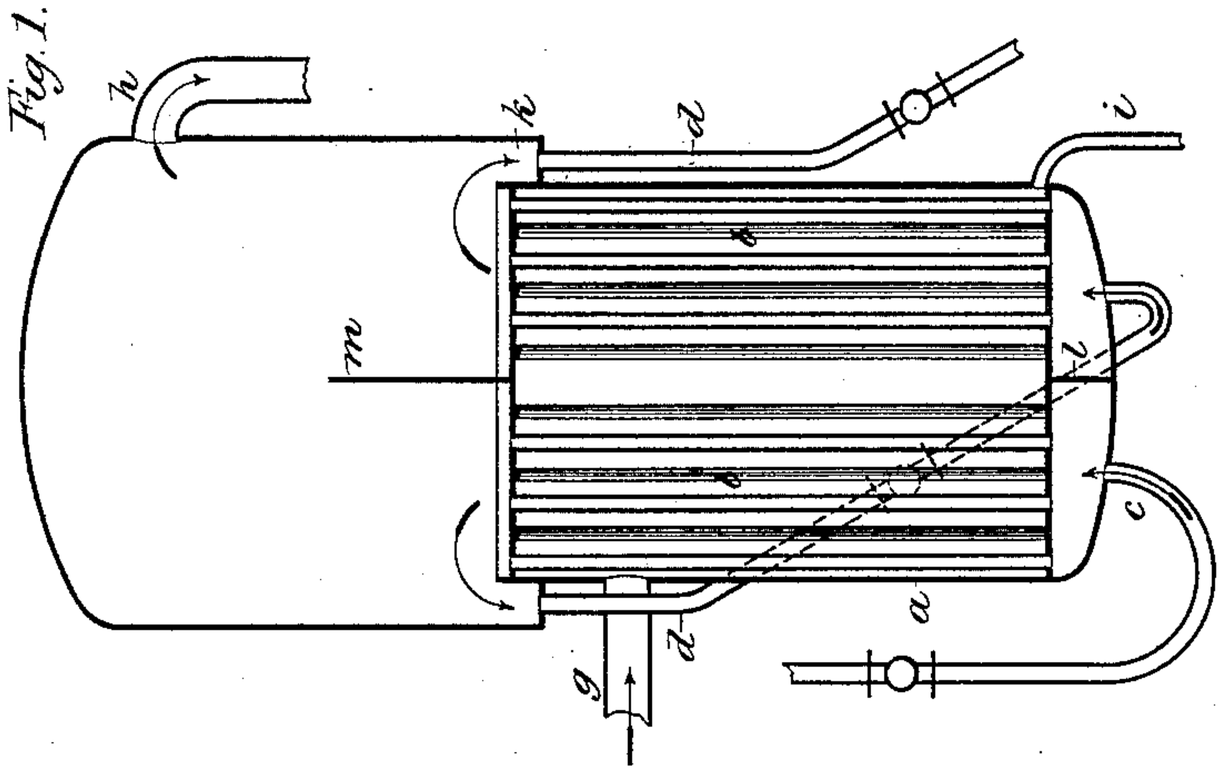
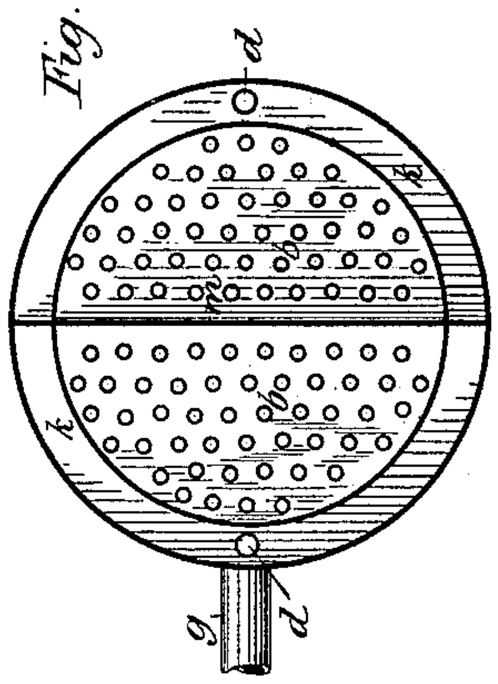


Fig. 2.



Witnesses:

J. A. Criswell

George Dixon.

Inventor:

Alfred Chapman

By his Attorneys,

Arthur G. Fraser & Co.

UNITED STATES PATENT OFFICE.

ALFRED CHAPMAN, OF LIVERPOOL, ENGLAND.

EVAPORATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 411,011, dated September 17, 1889.

Application filed October 6, 1888. Serial No. 287,441. (No model.) Patented in England February 6, 1888, No. 1,752, and in British Guiana March 27, 1888.

To all whom it may concern:

Be it known that I, ALFRED CHAPMAN, engineer, a subject of the Queen of Great Britain, residing at Liverpool, England, have invented certain new and useful Improvements in Apparatus for Evaporating Saccharine or other Solutions or Liquids, (for which I have obtained Letters Patent in England, No. 1,752, dated February 6, 1888, and in British Guiana, dated March 27, 1888,) of which the following is a specification.

The efficiency of apparatus such as is generally employed for the evaporation of saccharine or saline or other solutions or liquids, whether by simple double or multiple effect, depends in a great measure upon the circulation maintained in them of the liquid to be treated. With the ordinary construction, in which a number of vertical tubes pass through a steam-drum in the evaporating pan or vessel, the liquid is delivered to the pan at the part thereof which is below the drum, then rises through some of the tubes, descends through others of the tubes, and then leaves the pan by an outlet at the lower part, the vapor which is given off rising to the upper part of the pan and being conveyed to the steam-drum of the next pan of the series, or to a condenser.

Various arrangements have been proposed for insuring a good circulation of the liquid through the tubes which pass through the steam-drum—such, for example, as making some of these tubes larger than the others or by employing tubes within tubes, in a manner resembling Field boiler-tubes, so that the liquid may travel in the one direction through the inner tubes and in the other direction through the annular spaces between the inner and outer tubes; but these arrangements have not always proved satisfactory in working. Further, in the arrangements hitherto employed there is a tendency for some of the liquid to flow from the inlet to the outlet of the pan without any portion of it being evaporated.

Now, the present invention consists in the sprecial construction of one of those evaporating-pans in which the outlet, instead of being in direct communication with the part or space of the pan which is below the steam-drum, is in communication with the part or space which is above the drum, so that as no liquid can reach the outlet without passsing up through the tubes in the drum a good circulation is thus insured.

In the accompanying drawings, Figure 1 is a vertical section showing a pan in which my improvements are embodied. Fig. 2 is a horizontal section of the pan, the pan being separated, except the drum and the steam-space at the upper part, into two divisions. Figs. 3 and 4 are views corresponding, respectively, with Figs. 1 and 2, but showing a set of two connected pans which are not separated into divisions, as in the arrangement shown in Figs. 1 and 2.

The same letters of reference indicate the same or corresponding parts in all the figures.

Referring first to Figs. 1 and 2, *a* is the steam-drum.

b b are the vertical tubes in the drum, through which the liquid under treatment flows or circulates upward, as in an ordinary evaporating-pan.

c is the inlet for liquid to the pan.

l is a partition at the bottom of the pan, dividing the portion below the drum into two parts.

m is a corresponding partition above the drum, extending sufficiently high to insure that the liquid when boiling shall not pass over its upper edge.

d is a single tube fitted to each division of the pan for the downward flow of the liquid. Instead of this tube discharging the liquid into the lower part of the same space or division of the pan as is usual in evaporating-pans, it is carried direct to the liquor-inlet *c* of the next division of the same pan; or in case of the last division of the pan the tube *d* is carried to the inlet of the first division of the next pan of the series, or it is connected with the extracting-pump in the case of a simple-effect apparatus, or when the pan is the last pan of the series.

k is a recess or well around (or it may be only partly around) the upper part of the drum. The tubes *d* are connected with this recess, so that the liquid which flows up the

tubes *b* in the drum and runs over into this recess shall pass down the tubes *d*.

g is the inlet for steam or vapor to the drum.

h is the outlet for vapor from the upper part of the pan, communicating with the vapor-inlet *g* of the next pan of the series or with the condenser in the case of a simple-effect apparatus, or when the pan is the last of the series.

i is the outlet for condensation-waters from the drum.

The modification shown in Figs. 3 and 4 will be understood without further explanation. The pan not being divided, there is simply one downflow-tube *d*, through which the liquid, after having passed up the tubes *b*, flows direct to the liquid-inlet *c* of the next pan, or to the extracting-pump in the case of the last pan of the series.

I claim as my invention—

1. In an evaporating-pan, the steam-drum *a* and the tubes *b* therethrough for the upward flow of the liquid, in combination with the recess or well *k*, the bottom of which is below the upper ends of said tubes *b*, and a downflow-tube *d*, extending from the bottom of said recess or well, substantially as set forth.

2. In an evaporating-pan, the combination, with the steam-drum *a*, and with the tubes *b*, for the upward flow of the liquid, of the partitions *l* and *m*, recess or well *k*, and downflow tubes *d*, exterior to the pan, substantially as set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

ALFRED CHAPMAN.

Witnesses:
THOMAS ROBERTS,
THOMAS E. DRISKELL.